GUIDELINES FOR INSPECTION, PATCHING AND ACCEPTANCE OF EPOXY COATED REINFORCING BARS AT THE JOB SITE

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1983

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INTRODUCTION

In the past few years a large amount of the Ministry's funds has been expended on the inspection and repair of structures within the provincial highway system. Most of the deterioration has been caused by the corrosion of the reinforcing bars. This has caused extensive areas of concrete delamination and in some cases a severe reduction in the bar area has occurred.

The use of epoxy coated reinforcing bars within 100 mm of any surface exposed to deicing agents prevents the development of electrolytic corrosion cells within the concrete mass and hence provides a potentially long trouble free structure life.

The use of this material was introduced in bridge decks and barriers in 1979. In the spring of 1981 its use was extended to substructure elements directly exposed to salt splash and/or roadway drainage and areas affected by wind blown spray. In the areas where the coated steel is used in the structures the cost of the reinforcing has approximately doubled.

The above reasons outline the importance and necessity of developing a comprehensive method of inspection to ensure that the desired long term structure performance with a minimum of maintenance, is obtained.

INSPECTION REQUIREMENTS

The following outlines the criteria for the site acceptance or rejection of epoxy coated reinforcing bars:

Acceptable damage requiring no repairs

1) Hairline cracking in the coating on the outside radius of the bent bar, resulting from fabrication where the cracking is not accompanied by disbonding.

2) Where the damaged area is 25 mm^2 or less and the sum of all the damaged areas in any 300 mm length of the bar is two percent or less of the bar area.

Rejection or repair required to damaged areas

1) Where the damaged area is 25 mm^2 or less and the sum of the damaged areas in any 300 mm length of the bar is greater than two percent of the bar area, the bar should be rejected and removed (for bar areas see Table 1).

2) Where the damaged areas are in excess of 25 mm^2 they should be repaired unless the total damaged areas in any 300 mm length of bar is greater than two percent of the bar area in which case it should be rejected and replaced with an acceptable bar.

3) Hairline cracking accompanied by disbonding. All disbonded material to be removed and the areas are then evaluated as per the condition previously described.

4) Bars which have developed a heavy layer of rust should be rejected and replaced with an acceptable bar.

Bars shall be inspected for damage immediately after the initial unloading at the site, after placing and tieing and immediately prior to the pour.

Those areas requiring treatment should be patched with an approved material. Prior to patching all rust must be completely removed using a wire brush and emery paper. Repairs should not be carried out when the temperature of the bar and its immediate surroundings is less than $5^{o}C$ or when moisture is present on the bar.

MAXIMUM DAMAGE AREA PER 300 mm LENGTH
OF EPOXY COATED REINFORCING BARS

Bar Designation	Perimeter	Area mm^2 per 300 mm Length	2% of Area mm^2
10M	35.5	10650	213
15M	50.1	15030	301
20M	61.3	18390	368
25M	79.2	23760	475
30M	93.9	28170	563
35M	112.2	33660	673
45M	137.3	41190	824
50M	117.2	53160	1063

Table 1

FIELD OBERSERVATION

The following descriptions and illustrations depict the various good and unacceptable defects and practices associated with this material.

FIG. 1a - j - ACCEPTABLE AND UNACCEPTABLE COATINGS

Acceptable, straight and bent sections:

Fig. 1a - Acceptably Coated Straight Bar Section

Fig. 1b - Acceptably Coated Bent Bar Section

Cut ends of bars:

Fig. 1c - Uncoated Cut End of Bar Unacceptable, Occasionally Missed at Plant and Must be Treated on Site

Fig. 1d - Unacceptable Rusted Uncoated End of Bar

Fig. 1e - Properly Coated End of Bar

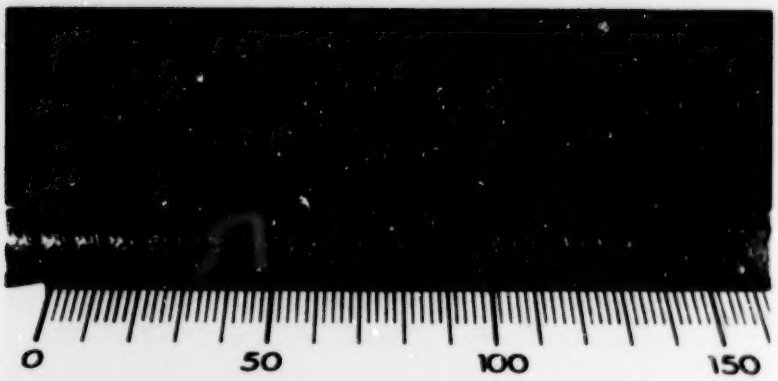

Fig. 1f - Minor coating imperfections. Acceptable without patching (less than 25 mm^2 , less than 2% of bar area in 300 mm length)

Fig. 1g - Coating damage requiring patching (greater than 25 mm^2 but less than 2% of total bar surface area in 300 mm length)

Fig. 1h - Deformed bar with hairline cracking on outside of the bend, no disbonding, is acceptable with patching not required

Unacceptable - Rejection Conditions

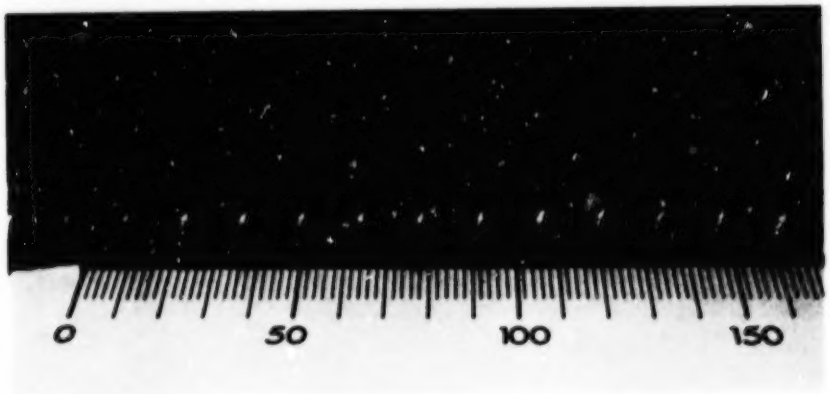

Fig. 1i - Bar with excessive damage to coating (greater than 2% of the bar area in 300 mm length) Rejection - patching not permitted

Fig. 1j - Bent bar badly cracked and disbonded (disbonded when removed is greater than 2% of the bar area in 300 mm length) Rejection - patching not permitted

FIG. 2a-d - REPAIRING A DAMAGED BAR REQUIRES THE FOLLOWING STEPS

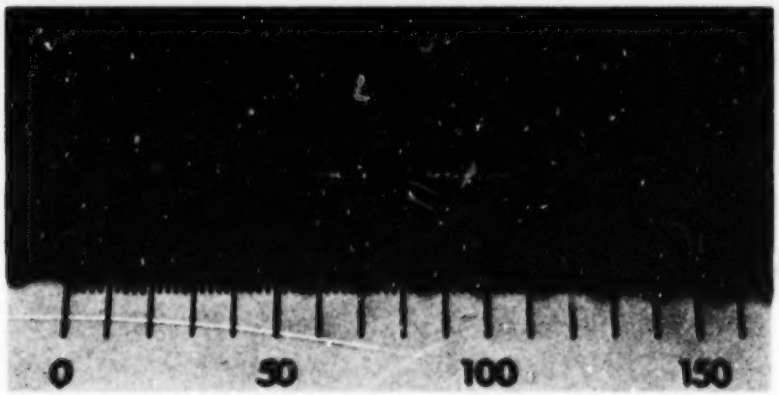

Fig. 2a - Damaged bar as received

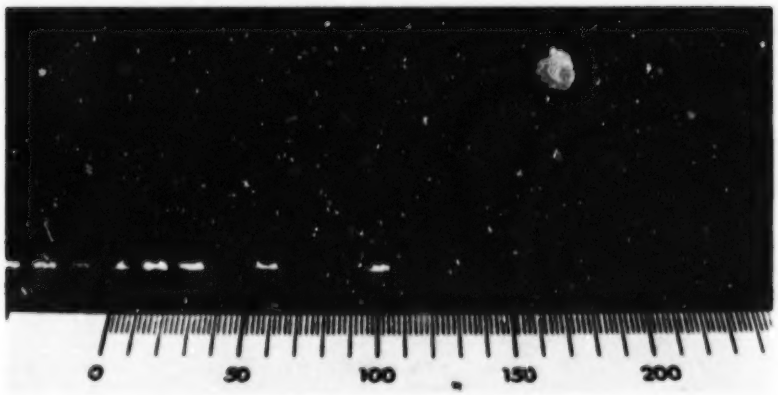

Fig. 2b - Bar after cleaning with wire brush and emery paper

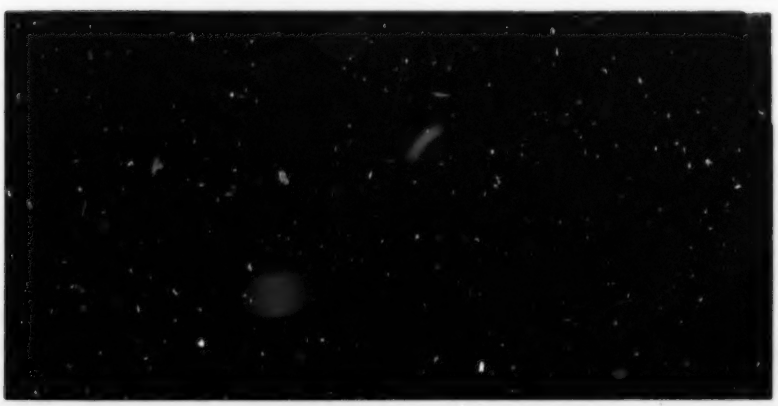

Fig. 2c - Preparing the approved patching material for use as per manufacturers instructions

Fig. 2d - Completed patch after application of epoxy patch material

FIG. 3a-g - HANDLING AND STORING

Fig. 3a - Load arriving at the site preparing to unload

Note the use of the required nylon slings around the bars, the frequent blocking along the length of the bar to avoid excessive vibration during transit precluding bar to bar abrasion.

Fig. 3b - Minimal damage to bars due to hold down devices during transport can be achieved by the use of nylon tie-down straps or sufficient padding between chains and the bundles

Fig. 3c - Lifting Steel - Good Practice

Note the minimal sag in the suspended bundle through the use of spreader cables or beam, also the blocking being placed prior to lowering on to the tied reinforcing mat.

Fig. 3d - Poor Lifting Practice - due to excessive deflection in bundle bar to bar abrasion will occur

Fig. 3d - Organized Storage Site

Bundles should be placed in an area readily accessible to the site where multiple handling will not be required. Bundles should be placed on blocks, in a single layer, to prevent excessive sagging and surface contamination, and should not be intermixed with regular steel bars.

Fig. 3f - Poorly Stored Bars

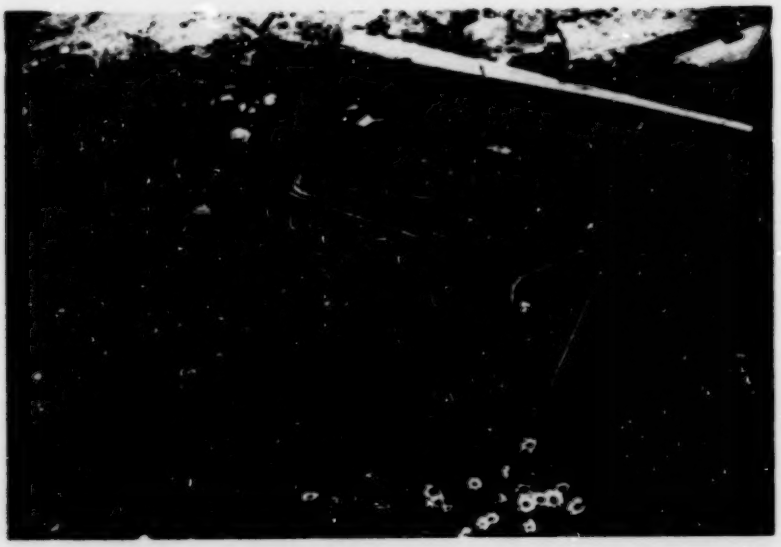

Fig. 3g - Unacceptable Storage Practice

FIG. 4a and b - CONSTRUCTION PRACTICES

Fig. 4a - Good fabrication of cage, clean, tied with coated wire

Fig. 4b - Poor Construction Practice

All epoxy bars to be protected from abrasion prior to and during the placing of concrete

FIG. 5a and b - SPIRAL CAGES FOR COLUMNS

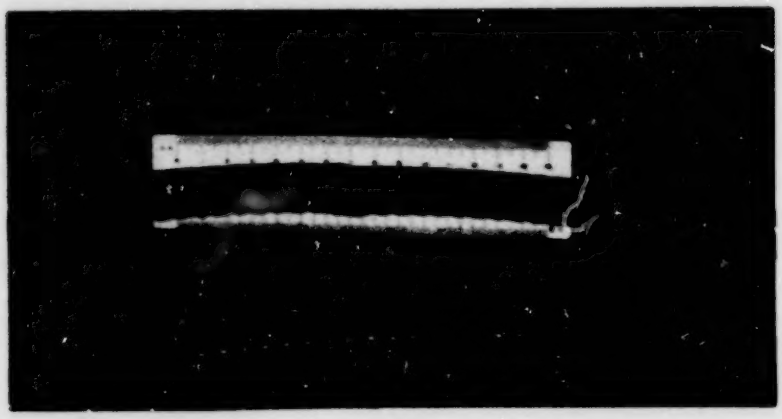

Fig. 5a - Fusion but weld joint prior to cleaning & patching at the fabricators

Fig. 5b - Typical spiral cage with coated spacer bars in place

POOR

QUALITY

ORIGINAL